DOCUMENT RESUME

ED 387 310 SE 054 756

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TITLE	Parental Practices in Families of Super-Achieving Math and Science Students.
INSTITUTION	Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE	Aug 94
NOTE	29p.
PUB TYPE	Reports - Research/Technical (143)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Educational Research; High Schools; Mathematics Education; Parent Attitudes; Parent Child Relationship; Parent Participation; Parent Role; *Science Education; Science Projects

ABSTRACT

This paper examines parenting practices reported by 29 seniors who won scholarships in the 1990 Westinghouse Science Talent Search (STS) for projects in mathematics or science. It uses measures of parenting developed by Sanford Dornbusch and others: Parents are "authoritative" if they encourage family discussions of controversial topics, prefer democratic decision making, give praise and expand freedom to make decisions for a good grade, and restrict student freedom and encourage improvement in response to a poor grade. "Authoritarian" parents discourage debate and questioning of parents' ideas, get upset and punish their child for a poor grade, and tell the child with good grades to do even better. "Permissive" parents indicate that grades and hard work in school are not important, have no rules about television, are not involved in high school activities, and do not help their child with homework or check to see if it is done. Results indicated that STS students ranked their parents very low on the authoritarian index. (Author/ZWH)

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SE 054 756
Jan. 95

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August, 1994

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Patricia Lines was a visiting professor at Catholic University of America while the data for this paper were gathered and is now a senior policy analyst at OERI. Jill Clark Hawley was an intern with the Office of Educational Research and Improvement, United States Education Department (OERI/USED) intern and is now assistant director for Agenda 21, a nonprofit project examining Colorado's future in education.

The authors wish to thank Sanford Dornbusch, of Stanford University, for his generous sharing of data and data instruments. For helpful suggestions on earlier drafts of this paper, the authors are indebted to Dornbusch, Marsha Brown of South Seattle Community College, John Convey of Catholic University of America, and Charles Masten of OERI/USED. Finally, they are very grateful to the students and parents who returned the questionnaires that provided the basis for this study.

An earlier report, with additional findings, is available in Jill Clark [Hawley], Family Processes Associated With Outstanding Achievement in Math and Science by High School Seniors, Senior Honors Thesis in Public Policy, Stanford University, Fall 1991. The data used in this working paper include one additional parent questionnaire (returned late) and additional data on parental education supplied by a student.

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This paper is intended to promote the exchange of ideas among researchers and policy makers. The views are those of the author, and no official support by the U.S. Department of Education is intended or should be inferred.

Abstract

This paper examines parenting practices reported by 29 seniors who won scholarships in the 1990 Westinghouse Science Talent Search (STS) for projects in mathematics or science. It uses measures of parenting developed by Dornbusch and others: Parents are "authoritative" if they encourage family discussions of controversial topics, prefer democratic decision making, give praise and expand freedom to make decisions for a good grade, and restrict student freedom and encourage improvement in response to a poor grade. "Authoritarian" parents discourage debate and questioning of parents' ideas, get upset and punish their child for a poor grade, and tell the child with good grades to do even better. "Permissive" parents indicate that grades and hard work in school are not important, have no rules about television, are not involved in high school activities, and do not help their child with homework or check to see if it is done. Dornbusch and his colleagues found a relationship between authoritative parenting and high academic achievement in children, and between low academic achievement and either permissive or authoritarian parenting.

Consistent with the earlier research, STS students ranked their parents very low on the authoritarian index. However, they fell below the Dornbusch mean on the authoritative index when we expected them to be well above it, and they fell above the Dornbusch mean on the permissive index when we expected them to be below it. Analysis of pure parenting – where parents were rated high on only one index – confirmed the Dornbusch-based hypothesis for the authoritarian index. An analysis of STS whites only – the group most likely to confirm the research hypothesis – confirmed it for the authoritative and authoritarian indices, but not the permissive index. Three times as many STS Asians and twice as many STS whites reported purely permissive parenting than did the Dornbusch students.

We concluded that these parents had judged their children to be mature and sought to encourage independence. This is based on comments from parents, such as "no rules were needed," frequent discussions in the home concerning their child's math or science project, and students' reports that their parents were supportive. We suggest modification of the indices, and of advice to parents, in the light of these findings.

STS and Dornbusch students differed significantly and in the predicted direction on many of the individual items on the authoritarian index. However, STS parents were significantly authoritative only in offering praise for a good grade. Contrary to predictions, they never restricted their child's freedom in response to a poor grade (as authoritative parents would do). They had few, if any, rules for watching TV and did not often check to see if their child's homework was done (permissive traits).

We also noted a high degree of agreement between student responses and responses on a parallel questionnaire to their parents. Finally, we were struck by the high level of interest and involvement among fathers, who returned half the parent questionnaires. In most education studies, fathers return less than 20 percent of the questionnaires.

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Introduction

This paper describes parenting practices found in families of high school seniors who achieved national recognition in 1990 for outstanding work in mathematics or science. The students were finalists that year in the 49th annual Westinghouse Science Talent Search (STS). The students conducted independent research in science or mathematics and prepared and submitted a paper on their research to STS. Judges – volunteers from the scientific community – identified finalists based on a review of each paper and with information submitted about the author's academic credentials and goals. While the group studied is small in number, the analysis utilizes the findings of Sanford Dornbusch[1] and others, based on large-scale studies, to determine expectations for parental practices associated with high academic achievement.

Relevant Research

Developing research by Dornbusch and others link certain parenting practices with high academic achievement. This research distinguishes between authoritative, authoritarian, and permissive parenting. Researchers classify parents as authoritative when they set clear standards, expect their child to act maturely, encourage independence and individuality, listen to their children's point of view, and encourage debate. Authoritarian parents are those who attempt to control the behavior and attitudes of their children, requiring their child to conform to an absolute set of standards. These parents value obedience, respect for authority, work, tradition, and preservation of order. They discourage debate. Permissive parents tolerate their child's impulses, punish rarely, avoid asserting authority and avoid controls or restrictions. They do not demand mature behavior, but instead allow children to regulate their own behavior and make their own decisions.

Dornbusch and his colleagues and others[2] have found a consistent link between authoritative parenting and academic achievement in children, with a few exceptions.

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[1]Most of the comparisons will be with the students studied in Dornbusch et al., "The Relationship of Parenting Style to Adolescent School Performance," (cited in full in the bibliography). This study hereinafter will be cited as Dornbusch.

[2]Diana Baumrind and Laurence Steinberg are also doing similar work. Baumrind developed the parenting typology for families of younger children and Dornbusch extended it to families of adolescents.

For most groups, these researchers found lower academic achievement in children with permissive and authoritarian parents. They found some exceptions for specific ethnic groups. For the purposes of this study, the most relevant exception concerns Asian families.[3] Asians generally rated their parents as more authoritarian, more permissive, and less authoritative than did his other students.[4] As is the case with other ethnic groups, lower academic achievement is associated with authoritarian parenting for Asians. However, Dornbusch found no correlation between academic achievement and scores on the permissive or authoritative indices for Asians. In fact, for Asian females, the correlation of grades with the authoritative index was negative (Dornbusch 1987, 1249).[5]

Dornbusch also found some effects due to immigrant status, sex, and parent education. He found parents with more education (typical of the STS white parents) were more authoritative, less permissive and less authoritarian than other parents. He also found differences in the parenting styles among first, second, and third generation Asians.[6]

Hypotheses

We expected parents of STS finalists to extend the patterns of high academic achievers, as suggested by this research. Thus, we expected students to report their parents as highly authoritative. Dornbusch defined high as above the 66.6 percentile. Thus, we expected the STS students to rate parents above the 66.6 percentile set by the Dornbusch students. We expected them to report their parents as not at all authoritarian and not at all permissive. We expected Asians to resemble the high achieving Asians in Dornbusch's sample and to have less authoritarian parents. We were unsure as to what to expect of the STS Asians on the other indices.

The STS Students

We mailed questionnaires to the 40 finalists and their parents. Twenty-nine students and 31 parents completed the questionnaire – a response rate of approximately 75 percent

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[3]Over half of the STS group is Asian. Dornbusch also found some differences for Hispanics, Dornbusch, p. 1253, but the STS students included only one Hispanic.

[4]The differences between Dornbusch Asians and whites were significant on all indices for both males and females, except for the permissive index for Asian females (computed from Dornbusch's published statistics, using a t test, and $p < .05$).

[5]Among Asians, he found near zero correlation between academic achievement and authoritative parenting. This was also true of permissive parenting.

[6]Dornbusch, "The Relation of High School Academic Performance and Student Effort to Language Use and Recency of Migration among Asian- and Pacific- Americans," (cited in full in the bibliography).

for each. We had 27 parent-student matches.

The students who responded were representative of the 40 finalists, which were disproportionately male and Asian. Of the student respondents 72.4 percent were male, and 51.7 percent were Asian. Most were from two-parent families (82.8 percent). Half the parent respondents were not U.S. citizens at birth. Most of the parents worked in professional or technical fields or in a college or university system. All parents, Asian and white, who reported some college had completed a four or five year program, with one exception involving a family in which one parent had a two-year degree and the other a graduate degree. Two white students did not have fathers present and their mothers did not report the education status of the father; for both, the mothers had advanced degrees. All white students were U.S. citizens at birth and had parents with at least a four-year college degree, with the one exception mentioned above. About half the Asian students were born outside the United States. Only one Asian student had both parents born in the United States.

The Dornbusch Survey and Indices

To provide a norm against which to compare the STS students, we adopted all of the questions and procedures developed by Dornbusch and colleagues[7] and other large surveys.[8] We adapted student questions for use in our parent questionnaire if a parallel parent questionnaire did not exist (Dornbusch did not interview parents). Dornbusch interviewed almost 8,000 students ages 14 through 18 from six high schools in the San Francisco area in the spring of 1985.

To measure parenting style, we used the indices developed by Dornbusch. Each index is independent of one another. Detail on the individual items is available in the Appendix. In summary, the authoritative index is based on the means of the following nine student responses concerning family behavior.

- Parents would: 1) tell the youth to look at both sides of issues, 2) admit that the youth sometimes knows more than adults, 3) talk about politics or religion within the family, and 4) emphasize that everyone should help with decisions in the family.

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[7]We utilized the procedures that formed the basis for the 1987 article. Dornbusch subsequently revised the formulae to standardize each item to ensure that all items would have equal weights.

[8]A few questions came from the High School and Beyond (HSB) 1980 student and parent questionnaires and the National Educational Longitudinal Study (NELS) 1988 parent questionnaire. None of these larger studies provided a perfect comparison. The HSB survey was of students who were seniors 10 years before the students in this study. The NELS survey will allow the closest comparison when the 1992 data on seniors becomes available.

- As a response to a good grade, parents would: 5) praise the student, and 6) give the student more freedom to make decisions.

- As a response to a poor grade, parents would: 7) take away freedom, 8) encourage the student to try harder, and 9) offer to help.

The authoritarian index is based on the mean frequency of the following eight student responses concerning family behavior:

- Parents would tell their youth: 1) not to argue with adults, 2) that he or she will know better when grown up, and 3) that the parents are correct and should not be questioned.

- As a response to a poor grade, parents would: 4) get upset, 5) reduce the youth's allowance, or 6) "ground" the youth.

- As a response to a good grade, parents would: 7) tell the youth to do even better, and 8) say that the students' other grades should be as good.

The permissive index is based on the mean frequency of the following eight student responses regarding family behavior:

- Parents would: 1) indicate that hard work in school is not important (the mean of four academic subjects), 2) indicate that they didn't care if the student received a poor grade or 3) a good grade, 4) establish no rules about watching television, 5) exhibit little involvement in their child's high school education, 6) fail to attend high school programs for parents, 7) fail to help with homework, and 8) fail to check the child's homework.[9]

Reliability of Indices

Individual responses used to build the indices were internally consistent for student and parent measures of authoritative parenting. For student responses, reliability was slightly higher than it was in the Dornbusch study on the authoritative and permissive indices. The reliability of the responses used to construct the authoritarian index was lower, but respectable. For parent responses, reliability was about the same as it was for the Dornbusch students on the authoritative index, and was even higher for the authoritarian

[9]These are also described in Dornbusch 1987, 1246 1247. Table 5 provides further detail on each item.

and permissive indices.[10]

Table 1
Mean Parenting Style reported by Students and Parents

	Authoritative	Authoritarian	Permissive	N
Student Mean	3.46	2.82	3.17	29
Standard Deviation	(.56)	(.36)	(.47)	
Parent Mean	3.84	2.90	2.84	31
Standard Deviation	(.48)	(.48)	(.50)	
t value of differences	-4.6**	-1.81	5.42**	
Correlation/pairs	.634**	.466*	.835**	27

* Significant at $p < .001$.
** Significant at $p = .014$.

Because we had a parallel questionnaire for parents, we were also able to assess the reliability of student responses compared to parent responses. As shown in Table 1, parent and student responses were correlated, although parents consistently rated themselves higher on the authoritative index and lower on the permissive index. Our guess is that parents may have had clear standards for their children but did not discuss them at length because their children were demonstrating mature behavior. A tendency to rate oneself favorably may pay a role, but this did not appear to affect the correlation between parent and student ratings.[11] That is, the relative position of any family would be similar, whether you looked at the student or the parent indices for these two indices.

[10]For students, Cronbach's alpha coefficients were .77 for the items making up the authoritative index; .56 for the authoritarian index, and .69 for the permissive. For parents, they were .67 for authoritative, .80 for authoritarian, and .64 for permissive. For students, two of the variables making up the authoritarian index had zero variance, and therefore were excluded from the computation of the reliability coefficient. For parents, one item on this index had zero variance and was excluded. For Dornbusch's students they were .66 for authoritative, .70 for authoritarian, and .60 for permissive. Dornbusch et al. 1987, p. 1247.

[11]See Schwarz 1985, 478. Parents tend to rate themselves more favorably than the child. When we adapted the student questions for use in our parent questionnaire, some questions almost guaranteed a different response between parents and students. For example, a student might say that his or her parent "doesn't care" or "doesn't think it important" that the student get good grades, but a parent would be unlikely to agree. As a result, parent-student composite scores were different, but they did co-vary.

Findings

Table 2 provides comparisons of STS and Dornbusch student ratings, in the aggregate, and by race (STS whites and STS Asians only). Table 2 compares the STS students with Dornbusch 17-year-olds where data was available by age in the published source. As age of Dornbusch's students increased, authoritarian scores declined somewhat, and permissive scores steadily increased. Almost all the STS students were 17 by the time of the survey.

We found predictions based on the Dornbusch framework are true for the authoritarian index. On average, STS students rated their parents much less authoritarian than did the 17-year-old Dornbusch students. However, the Dornbusch framework did not predict the STS ratings on the other two indices. STS students reported their parents as more permissive and less authoritative than did the students in the Dornbusch study. The result holds whether we treat the STS group as a small population and the Dornbusch sample as providing norms or if we treat the STS and Dornbusch groups as independent samples.[12]

The STS Asian students rated their parents significantly more authoritarian and more permissive than the white students did.[13] However, examination of Asians and whites separately fails to confirm the hypothesis for the authoritative or permissive indices. As predicted, STS whites are well below the Dornbusch average on the authoritarian index. However, they are average where we expected a high score (above the 66.6 percentile) on the authoritative index; and average where we expected a low score on the permissive

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[12]An analysis of the distribution of the difference between means yielded $t = -1.04$ for the authoritative index; $t = -7.14$ for the authoritarian index; and $t = 1.13$ for the permissive index. At $p = .05$, a t must be 1.65 or more to be significant. In short, the STS students are "average" by the Dornbusch standard on the authoritative and permissive indices and well below average on the authoritarian index.

[13]Using a t test, we find STS Asians report their parents significantly more authoritarian ($t = 2.67$, $p = .013$) and more permissive ($t = 2.84$, $p = .009$). For the authoritative test, $t = -1.43$, $p = .164$.

Table 2
Mean Student Reports of Parenting Style

	Authoritative	Authoritarian	Permissive	N
All STS Students	3.46	2.82	3.17	29
	(.56)	(.36)	(.47)	
Predicted score for all STS	*>3.88*	*<3.28*	*<3.04*	
Dornbusch age 17 only	3.57	3.31	3.07	1654
	(.58)	(.62)	(.58)	
STS Whites	3.68	2.61	2.93	12
	(.48)	(.29)	(.33)	
Predicted score for STS Whites	*>3.88*	*<3.27*	*<2.93*	
Dornbusch Whites age 14-18	3.58	3.29	2.95	4553
	(.58)	(.61)	(.57)	
STS Asians	3.39	2.92	3.37	15
	(.55)	(.32)	(.45)	
Predicted score for STS Asians		*<3.42*		
Dornbusch Asians age 14-18	3.48	3.46	3.00	800
	(.58)	(.61)	(.61)	

The mean scores and standard deviations for the Dornbusch group are computed based on Dornbusch et al., 1987, Table 1. For the authoritative index, the predicted score is above the 66.6 percentile for the Dornbusch students. For the authoritarian and permissive indices, the predicted score is below the Dornbusch mean plus or minus (depending on the hypothesized direction) the standard error multiplied by 1.96 (for a 95 percent confidence level). We did not predict scores for Asians on the authoritative and permissive indices (see text).

index.[14] STS Asians were significantly below their Dornbusch counterparts on the authoritarian index. However, they were somewhat below average on the authoritative index, and significantly above Dornbusch Asians on the permissive index,[15] contrary to expectations for all students. The findings on the authoritarian index meet our expectations, based on the Dornbusch framework. The findings on the authoritative and permissive indices do not.[16]

Dornbusch also analyzed "pure" parenting styles. A subject reports a pure parenting style if his or her score is in the top one-third on only one index (Dornbusch 1987, 1247). Grades for children from purely authoritative families were much higher than grades of children from purely authoritarian or purely permissive families. Table 3 shows the frequencies of purely parenting styles reported by STS and Dornbusch students.

Analysis of pure parenting confirmed the finding for the authoritarian index: no STS students rated parents as purely authoritarian, compared to 15 percent of the Dornbusch students. Once again, the hypothesized framework did not predict results on the other two indices. STS students reported a predominant style of permissive parenting, with 52 percent rating their parents as permissive (above 3.2 on the permissive index). Over twice as many rated parents high only on the permissive index (41 percent) than did the Dornbusch students (18 percent). The proportion of STS students reporting purely authoritative parenting (21 percent) is somewhat higher than that reported by the Dornbusch students (17 percent).

Given the effects Dornbusch found for race and parental education, the comparison most likely to produce the hypothesized results would be a comparison of the STS whites to the Dornbusch total. When we did this, we found a high frequency of authoritative parenting (42 percent for STS whites and 17 percent for Dornbusch students). This is the only statistical manipulation that we performed that confirmed the Dornbusch framework for the authoritative index. We note that differences on the other two indices were not significant, but this may be a function of the small number of STS whites. This seems especially true for the authoritarian index, where the difference is in the predicted direction and where every other mode of analysis confirmed the research hypothesis.

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[14]For the authoritative, authoritarian and permissive indices, respectively, $t = .73$, -8.15 and -.24. A t of 1.645 would be significant at $p < .05$.

[15]For the authoritative, authoritarian and permissive indices, $t = -.63$, -6.32 and 3.13 respectively.

[16]The published Dornbusch data do not provide the 33.3 percentile, which would provide a definition of "low" that would be parallel to the Dornbusch definition of "high" at the 66.6 percentile. Moreover, a test of the formula indicated the Dornbusch distributions were skewed. On the other hand, the scores of STS students were so low on the authoritarian index that it is clear they were well below this point and, on the permissive index, it was clear that they were average or above.

Table 3
Pure Parenting Styles
(High Only on One Index)
Frequency by Ethnicity

	Authoritative	Authoritarian	Permissive	N
Total STS	21%	0*	41%*	29
Total Dornbusch Age 14–18	17%	15%*	18%*	7836
STS Whites	42%*	0	25%*	12
STS Asians	7%*	0	53%*	15
STS Whites	42%*	0	25%	12
Total Dornbusch Age 14–18	17%*	15%	18%	7836

* Differences between the two groups within each set are significant at $p < .05$ using Pearson's chi square.

The total STS number (29) is larger than the total of STS Asians and whites (27) because there were two additional minority students in the survey.

Probing the Demographic Differences

As noted at the outset, Dornbusch found the indices sensitive to race, parental education, immigrant status, and sex of student. Moreover, the STS students were disproportionately male, Asian, from families with well educated parents and an unusually large number were born outside the United States. The analysis thus far has accounted for the disproportionate number of Asians in the STS group by comparing Asians and whites separately to the Dornbusch standard. We probed for other possible biases in the STS group by assessing the extent to which the available demographic variables – race, father's education, mother's education, student's citizenship at birth, age of student, and sex of student – influenced each index.

Just one variable appeared to influence each index. Sex appeared significant on the authoritative index. Mother's education emerged as significant on the authoritarian index, and student's citizenship at birth emerged on the permissive index.

STS girls view their parents as significantly more authoritative (a mean of 3.71) than do boys (a mean of 3.36).[17] Sex remained a significant factor even after controlling for the other demographic variables.[18] However, we do not think that the disproportionate number of males in the STS group affected our conclusions for any of the indices. The Dornbusch data, based on much larger numbers, suggest no large influence on any of the indices due to sex. Dornbusch found a significant difference by sex only on the authoritarian index, where boys reported a higher incidence of authoritarian parenting (3.41 for boys, 3.34 for girls).[19] There were some differences by sex within ethnic groups among the Dornbusch students, but most were not relevant to a study of the STS group. The low authoritative score for high achieving Asian girls in the Dornbusch sample was not typical for the STS girls.[20] Finally, if we analyze the mean for STS girls alone, we still cannot distinguish them from average students in the Dornbusch group, and we therefore reject the possibility that the disproportionate number of males has skewed our results on the authoritative index. On the other hand, the finding is

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[17]A stepwise regression analysis of these demographic variables indicated that the sex of the student accounted for 17% of the variation among STS students on the authoritative index. $R^2 = .169$, and the adjusted $R^2 = .131$, at $p = .046$. The variable remained in the equation at $p = .05$ and was removed at $p = .1$. No other variables qualified to enter the equation.

[18]With all the variables in the equation, $R^2 = .36$; adjusted $R^2 = .127$; and $F = 1.56$, at $p = .2$. For sex, $t = 2.25$ at $p = .038$.

[19]If this effect is operating on the STS group, the result would be an even lower authoritarian index, and our conclusions would be undisturbed.

[20]Both Asian and white STS girls were above the STS average. Differences between STS girls by race were significant only on the authoritarian index.

intriguing. There is a small chance that it may be due to random factors. On the other hand, it may suggest that girls who receive strong authoritative support from parents are more likely to achieve in mathematics and science. Possibly boys interested in these subjects have a wider range of sources for such support. This would be worth exploring in future research.

On the authoritarian index, mother's education emerged as the most influential demographic factor, inversely related to authoritarian score, and accounting for 25 percent of the variation among STS students.[21] When we control for the other demographic variables, this finding does not persist. As the STS authoritarian score is extremely low, and includes a large number of Asians (who scored higher on the authoritarian index in the Dornbusch group), it seems likely that the low score is related to outstanding achievement and not to demographic variables.

On the permissive index, student's citizenship at birth accounted for 36 percent of the variation among students.[22] Asians who were not U.S. citizens at birth averaged 3.57 on the permissive index; Asians who were citizens at birth averaged 3.14; and whites, all of whom were citizens at birth, averaged 2.93.[23] When we control for other demographic variables, the unique effect of citizenship is no longer significant. If the high permissive score of STS students is due, in part, to a combination of demographic variables, it does not alter our conclusions as whites alone were only average on the permissive index; the hypothetical framework would have required them to be low. Moreover, all whites reported high education status for their parents and all were U.S. citizens at birth – variables that would further depress the permissive score if demographic variables were biasing the results.

Analysis of Individual Items in Indices

Because we could confirm the Dornbusch theoretical framework for the authoritarian index only, we probed the individual items in each index for clues. The Appendix provides details on the results. Analysis of individual items is consistent with our robust results on the authoritarian index. All STS-Dornbusch differences were significant and all except one sloped in the predicted direction: STS responses were lower than the Dornbusch average on all items, except that many parents "sometimes" said the student would know better when grown up. Dornbusch students were more likely to report that their parents said this "rarely" or "never." This one item seems due to the influence of Asians in the STS group.

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[21] R^2 = .246; adjusted R^2 = .212; F = 4.17 at p = .01.

[22] R^2 = .358; adjusted R^2 = .330, and p = .002.

[23] Based on an analysis of variance, the differences between these means are significant at p = .004.

The STS parents were not as authoritative as we had expected. This is reflected in the analysis of the individual items in this index. STS students were significantly higher than Dornbusch students on only one item. STS parents were more likely to praise their students for a good grade; this result was heavily influenced by the response of the white STS students.[24] Contrary to the hypothesis, STS students scored significantly lower on four items: 79.3% of STS students said their parents would never give the student more freedom to make decisions as a response to a good grade, compared to 39.3% of the Dornbusch students. Similarly, 92.9% of STS students said their parents would never take away freedom to make decisions because of a poor grade, compared to 57.2% of Dornbusch students. As a response to a poor grade, 57.1% of STS students said their parents would "usually" encourage them to try harder, compared to 71.3% of Dornbusch students. Also in response to a poor grade, 46.4% of STS students said their parent would never offer to help the student, compared to 20.5% of Dornbusch students.[25]

As noted before, comparing STS whites with the Dornbusch total would most favor the research hypothesis. This comparison yielded three items with significant differences – one as predicted, one in a contrary direction, and one that was bi-modal, with half the whites moving in the predicted direction and the other half in a contrary direction. One of these items is worth commenting on: STS white parents, as was the case for the group as a whole, had never restricted a student's freedom to make decisions as a response to a poor grade. This item stands out as one of just two among all the individual items for all three indices where the differences between STS and the Dornbusch total persisted across STS racial groupings.

This item may suggest an adjustment to the authoritative index. We also note that STS students as a whole (and STS Asian students considered separately) were also less likely to grant greater freedom following a good grade, while STS white students sloped in the same direction (we can be 94% confident of this). These items resemble items in the authoritarian index, where all STS students said "never" in response to questions about whether parents would reduce their allowance or ground them because of a poor grade.

This pattern raises a question about any kind of reward or punishment as a response to grades. Punishment is rarely helpful to a student in academic trouble in school. Moreover, a small body of research suggests that the positive effects of rewards for

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[24]This is the only item discussed in this section where a significant difference between STS Asians and whites was found. See the Appendix, Part B.

[25]Note: we are missing the frequencies for the Dornbusch students for one of the items (parents would admit that the student sometimes knows more than adults).

academic success are temporary and that long term effects may even be negative.[26] It is possible that a mature student may see greater freedom as encouraging even more mature behavior; but our results suggest that the student is more likely to see it as part of a system of rewards and punishments. We suspect that most forms of rewards and punishments are associated with authoritarian, rather than authoritative parenting. With this adjustment, we believe that the authoritative index would become a better predictor of outstanding achievement in mathematics or science.

The analysis of individual items highlights a number of issues concerning the permissive index. To the extent that there are significant differences, they indicate a higher permissiveness among STS parents compared to Dornbusch parents. The second of the two items where both STS whites and Asians went in the "wrong" direction was an item on this index: According to their students, STS parents established fewer (or no) rules regarding television viewing. In addition, STS students, as a group, reported that their parents less often checked to see if they had completed homework, compared to Dornbusch students.

Exploratory Findings on the Permissive Index

The permissive index was the weakest in predicting outstanding achievement in mathematics and science. As such, it requires special scrutiny. This index was designed to measure the extent to which parents tolerated student impulses, demanded mature behavior, and adopted a laissez faire attitude, allowing their children to make their own decisions. The actual items in the permissive index measure parental involvement in high school activities, supervision and help in homework, parental attitude towards good and poor grades and rules on television watching.

Our survey included a number of questions that were exploratory, with no larger surveys available for comparisons. We examined these for clues to the high permissive score for STS families. The individual questions focusing on rules – rules about television viewing, rules about homework, and so forth boosted the permissive score. STS parents made it clear that they thought rules were not needed. We had asked for marginal

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[26]Alfie Kohn reviews these studies in Punished by Rewards: The Trouble with Gold Stars, Incentive Plans, A's, Praise and Other Bribes (New York: Houghton Mifflin Co., 1993). While Kohn is not an education researcher, he does a careful and competent job of reviewing the studies, relying only on studies that used a control group, for example. The following are examples of studies he reviewed, all of which are published in academic journals: Louise Brightwell Miller, University of Kentucky, paid one group of randomly assigned 9 year old boys for their right answers on a test. A second group that was not paid did significantly better on the same test. In another study, college students presented with a tricky structural problem, took 50% longer to complete the task when paid. In another, children who were paid to do a mathematical game, avoided that game after payments ceased and turned to a second game that had been determined to be roughly equal in appeal. Kohn theorized that most intellectual work is its own reward, and that payment suggests that it is not so rewarding after all.

comments and we got them. In the margin next to the questions which pertained to rules, many of the parents scribbled comments such as, "not necessary," "didn't need any," or "he made his own decisions." These parents might be characterized as demanding mature behavior, but the instrument was not designed to detect their assessment that their children were in fact mature.

Some of the questions in the permissive index were based on parental involvement in the child's education. Although the STS results seem to suggest that these parents were not highly involved, some of the exploratory questions suggested that the involvement was intense. The STS parents were involved chiefly through family discussions with their children. In response to a question asking parents how they encouraged their student to work hard, 73.3% said they usually did so by showing interest in their child's activities. A majority of students and parents reported discussing school in the home at least once per week. About a third of the students, and almost two-thirds of the parents said this occurred at least once per day. In response to an open-ended question for students about their parents' most important contribution to their success as a STS finalist, 25 of the 27 students (92.6%) said support and/or encouragement. A second question asked both the students and their parents how frequently they discussed the student's science or mathematics project. The parent and student responses to this question were remarkably similar: 50% of the students and 51% of the parents said they discussed the project at least once per week. We conclude that parents were involved in their student's education but through expressions of interest and discussion, rather than through participation in or support of school-related activities.

We thought this activity fit Reginald Clark's "communication style," of sponsored independence. Sponsored independence is marked by such items as the following: a high degree of parent involvement and interest in the child's home activities; frequent parent and child activities involving reading, writing, conversing, and creating; consistent expectations and standards for responsible behavior; and regular expression of praise for the child's efforts. Unsponsored independence is marked by the opposite of these characteristics.[27] Clark found that children from families in which sponsored independence is the predominate communication style tend to be high achieving, well-adjusted youth. In contrast, children from families characterized by unsponsored independence communication style tend to be low achieving and poorly-adjusted. Clark's communication styles appear to focus almost entirely on parent interaction with the student in the home. His communication styles place less emphasis than the Dornbusch framework on parent involvement in the school. Clark places more emphasis on the existence of parental support of the child's activities and less emphasis on the existence of rules. We note that Clark was studying a different population altogether – poor black families – but some parenting techniques may be effective for a wide range of families.

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[27]Clark 1983, p. 2.

Exploratory Finding: the Role of Fathers

The interest and involvement of fathers was not something that we were looking for, but it became apparent as soon as the questionnaires came in. Of the 31 parent surveys we received, 15 were completed by fathers, 1 by a mother and father cooperatively, and 14 by mothers. The survey directed that "The parent most involved with your Westinghouse finalist's high school educational activities should answer this questionnaire." Typically, mothers are the ones to return surveys about a child's education. For example, fathers were 17.5% of those responding to the NELS 1988 parent questionnaire, which instructs that "This survey should be completed by the parent or guardian who is most familiar with the student's current school situation and educational plans." This finding deserves probing in future studies of this type. It could be that fathers of eighth-graders (the NELS88 survey) and that parents of high school seniors differ. It could be that fathers are more interested and involved when the subject is mathematics and science. However, it is also possible that the involvement of fathers is important to a child's outstanding academic success.

Conclusion

We had expected the STS students to extend the trends established by the Dornbusch study, and to be high on the authoritative index (above the Dornbusch 66.6 percentile), and low on the authoritarian and permissive indices (below the Dornbusch mean). We found the STS students were very low on the authoritarian index. However, we could not confirm the research hypothesis for the other two indices, although there was some evidence in support of the hypothesis for whites only. Because whites and more highly educated parents tended to follow the Dornbusch framework best, a comparison of STS whites (all of whom had highly educated parents) with the Dornbusch students was most likely to confirm the hypothesis. Even in this comparison, we could confirm the research hypothesis for the authoritative and authoritarian index, but not for the permissive index. Both STS whites and Asians reported average to high permissive parenting, when we expected it to be low.

Cause and effect remain elusive. It could be that avoidance of authoritarian practices encourages students to engage in challenging, independent work. On the other hand, a student's obvious ability and maturity could encourage a parent to abandon authoritarian practices. Likewise, permissive parenting does not necessarily promote outstanding achievement in mathematics and science. It seems more likely that parents become more permissive as the child matures, and that STS students were mature.

So what should researchers tell parents? Provided that researchers adequately explain the difficulty of determining cause and effect, the research does provide some direction. Given the robustness of the Dornbusch authoritarian index in his own research and in ours, this index presents a sound basis for advice to parents. The Dornbusch research

indicated that authoritarian parenting was not productive. Our research confirms this in that it reveals a dramatic absence of authoritarian parenting for super-achievers. The authoritative index provides a less clear ground for advice to any except white, middle-class parents. We believe it would be a better guide to academic success if the items on increasing or decreasing freedom in response to grades were replaced. Questions about parental interest in the student's academic work or academically-related extra-curricular activities may provide a more appropriate measure of authoritative parenting.

The permissive index is troublesome, at least when applied to mature students. In this case, we believe researchers should consider a reconstructed index and further research before formulating advice to parents. Our research and Clark's suggest a different set of questions. To determine parental involvement, questions about discussion of serious matters – whether science or humanities – may be useful. To determine parental oversight, questions about the extent to which parents are aware of the time a student spends on homework, watching TV, and engaging in other activities may be revealing. The questions about how much parents care about good or poor grades (over 85% of Dornbusch students indicated that parents always care) were simply not good at discriminating among families. Parental concern about grades might better be discovered with questions about the extent to which parents know what grades the student gets on papers and quizzes, and the extent to which they discuss the student's report card.

Finally, it is important to be aware of differences among ethnic groups when developing advice for parents. Although we found a number of similarities across racial groups, we also found differences. There seems to be more than one pathway that parents can follow to promote academic excellence in children.

APPENDIX
INDIVIDUAL ITEMS USED FOR INDICES

If the STS student response favors the underlined response more than Dornbusch students, results are in the predicted direction. Each STS grouping was separately compared with the Dornbusch total. Differences between STS whites and STS Asians are outlined in the note at the end of this appendix.

** $p < .01$, Pearson's Chi Square for group indicated compared to the Dornbusch total.

* $p < .05$, Pearson's Chi Square for the distribution of the group indicated compared to the Dornbusch distribution.

INDIVIDUAL ITEMS IN THE AUTHORITATIVE INDEX

	Dornbusch Total %	STS Total %	STS Whites %	STS Asians %
As a response to a good grade, parents would praise the student.				
usually	58.3	62.1**	83.3	46.7
sometimes	25.7	31.0**	16.7	40.0
never	16.0	6.9**		13.3
			See note 1.	
As a response to a good grade, parents would give more freedom to make decisions.				
usually	25.1			
sometimes	35.6	20.7**	33.3	13.3**
never	39.3	79.3**	66.7	86.7**
As a response to a poor grade, parents would take away freedom to make decisions.				
usually	15.9			
sometimes	26.9	7.1**	18.2**	
never	57.2	92.9**	81.8**	100.0**

	Dornbusch Total %	STS Total %	STS Whites %	STS Asians %
As a response to a poor grade, parents would encourage the student to try harder.				
usually	71.3	57.1	54.5	60.0
sometimes	20.6	35.7	27.3	40.0
never	8.1	7.1	18.2	
As a response to a poor grade, parents would offer to help.				
usually	49.6	32.1*	54.5*	20.0
sometimes	29.8	21.4*		40.0
never	20.5	46.4*	45.5*	40.0
			See note 2.	
Parents would tell the student to look at both sides of issues.				
very often	13.5	10.3	8.3	13.3
often	27.8	34.5	41.7	33.3
sometimes	30.9	17.2	16.7	20.0
rarely	17.2	34.5	33.3	26.7
never	10.6	3.4		6.7
Parents would admit that the student sometimes knows more than adults.[28]				
very often		6.9	8.3	6.7
often		24.1	33.3	20.0
sometimes		31.0	33.3	33.3
rarely		6.9	8.3	6.7
never		31.0	16.7	33.3
Parents would talk about politics or religion with student.				
very often	10.0	17.2	25.0*	13.3
often	13.7	17.2	33.3*	6.7
sometimes	24.4	34.5	33.3*	40.0
rarely	20.6	17.2	8.3*	20.0
never	31.2	13.8		20.0

[28]Dr. Dornbusch very generously did some data runs for us to help produce this appendix. However, a typographical error in specifying variables resulted in the omission of this variable. He has since been too busy to redo the work.

	Dornbusch Total %	STS Total %	STS Whites %	STS Asians %
				See note 1.
Parents would say that everyone should have some say in family decisions.				
very much	20.3	13.8	8.3	20.0
pretty much	27.7	27.6	41.7	20.0
somewhat	24.0	27.6	33.3	26.7
not too much	16.0	17.2	16.7	20.0
not at all	12.0	13.8		13.3

INDIVIDUAL ITEMS IN THE AUTHORITARIAN INDEX

	Dornbusch Total %	STS Total %	STS Whites %	STS Asians %
As a response to a good grade, parents would tell the student to do even better.				
usually	22.2	6.9*	8.3	6.7
sometimes	32.4	24.1*	25.0	26.7
never	45.4	69.0*	66.7	66.7
As a response to a good grade, parents would say other grades should be as good.				
sometimes	35.4	20.7**	16.7*	26.7**
never	30.0	79.3**	83.3*	73.3**
As a response to a poor grade, parents would get upset.				
usually	55.8	7.1**		13.3**
sometimes	30.7	42.9**	45.5*	40.0**
never	13.5	50.0**	54.5*	46.7**
As a response to a poor grade, parents would reduce the student's allowance.				
never	86.0	100.0	100.0	100.0

	Dornbusch Total %	STS Total %	STS Whites %	STS Asians %
As a response to a poor grade, parents would 'ground' the student.				
never	63.8	100.0**	100.0*	100.0**
Parents would say that parents are correct and should not be questioned.				
very often	13.9	3.4		
often	14.6	6.9	8.3	
sometimes	27.2	20.7	16.7	26.7
rarely	26.0	44.8	41.7	53.3
never	18.3	24.1	33.3	20.0
Parents would say that student will know better when grown up.				
very often	9.8	6.9*		6.7
often	11.4	6.9*		13.3
sometimes	19.6	41.4*	25.0	53.3
rarely	25.9	10.3*	8.3	13.3
never	33.3	34.5*	66.7	13.3
			See note 1.	
Parents would tell the student not to argue with adults.				
very much	18.7	0.0*		
pretty much	18.3	6.9*		6.7
somewhat	22.2	13.8*		26.7
not too much	21.9	37.9*	41.7*	40.0
not at all	18.8	41.4*	58.3*	26.7
			See note 1.	

INDIVIDUAL ITEMS IN THE PERMISSIVE INDEX.

	Dornbusch Total %	STS Total %	STS Whites %	STS Asians %
Parents attended high school programs for parents (parent who attended most).				
always	7.0	6.9		6.7
usually	14.5	13.8	25.0	6.7
often	15.7	20.7	25.0	20.0
sometimes	31.5	37.9	25.0	46.7
never	31.4	20.7	25.0	20.0
Extent to which most involved parent was involved in the child's high school education				
extremely	25.6	13.8	25.0	
very	26.9	24.1	33.3	20.0*
moderately	26.3	41.4	41.7	40.0*
slightly	14.5	10.3		20.0*
not at all	6.6	10.3		20.0*
			See note 1.	
Extent to which most helpful parent helped with homework				
everyday	5.1	0.0		
2/3 times week	17.7	3.4		6.7*
2/3 times month	25.4	31.0	50.0	20.0*
2/3 times year	21.0	20.7	33.3	6.7*
never	30.8	44.8	16.7	66.7*
			See note 2.	
Parents believed that hard work in school is important (permissive index used inverse of mean for four academic subjects).				
extremely important	34.8	20.7	33.3	13.3
very important	33.8	48.2	33.3	60.0
moderately important	22.6	27.5	33.3	20.0
slightly important	6.9			
not at all important	1.9	3.4		6.7
Parents had rules about watching television.				
yes	69.7	24.1**	41.7*	13.3*
no	30.3	75.9**	58.3*	86.7*

	Dornbusch Total %	STS Total %	STS Whites %	STS Asians %
Parents didn't care if student got poor grades.				
usually	4.3	3.6		6.7
sometimes	7.9	10.7		13.3
never	87.8	85.7	100.0	80.0
Parents didn't care if student got a good grade.				
usually	4.3	6.9		13.3
sometimes	10.2	13.8		20.0
never	85.5	79.3	100.0	66.7
				See note 1.
Parents checked to see if student finished homework (most active parent for STS students; mother for Dornbusch students).[29]				
always	10.8	0.0*		
usually	12.0	0.0*		
fairly often	12.5	3.4*	8.3	
sometimes	23.3	31.0*	33.3	26.7
never	41.3	65.5*	58.3	73.3

[29]The correct variable was not available in the data runs that were done for us. See note 28.

NOTES ON INDIVIDUAL ITEMS - STS ASIANS AND STS WHITES COMPARED

Note 1. Differences between mean scores of STS Asians and whites

STS Asian students were less likely than whites to report:

- parents praise students for a good grade (authoritative index) t =2.15, p=.041;
- frequent discussion of politics and religion in the home (authoritative index), t =2.28, p=.032;
- parental involvement in the child's education (permissive index), t = 3.3, p=.003;
- parents cared about a good grade (permissive index), t =2.17, p=.040.

Asians were more likely to report:

- parents would say the student would know better when grown up (authoritarian index), t = -3.34, p=.003;
- parents would tell the student not to argue with adults (authoritarian index), t = -2.42, p=.023.

Although it did not meet our test of significance, there was also a tendency for Asians to report a greater incidence of: reduced freedom as a response to poor grades (p=.092); no parental help with homework (p=.078); and no rules for TV (p=.102).

Note 2. Differences in Distribution of responses of STS Asians and whites.

Pearson's Chi Square test revealed no significant differences in distributions in responses on the above items for which there was a significant difference between means. However, distributions were significantly different on the following:

- Asian responses were more evenly distributed when reporting whether parents would offer to help in response to poor grades (permissive index) (p=.036);

- Asians were less likely than whites to report that parents helped with homework (permissive index) (p=.031).

There were some additional differences in distributions between Asians and whites that did not meet our test of significance: how parents responded to a good grade (authoritative index) (p=.086); how often parents said the student will know better when grown up (authoritarian index) (p=.062); the extent to which a parent was involved in the child's high school education (permissive index) (p=.061); rules for television (p=.095) (permissive index); and whether parents cared about a good grade (permissive index) (p=.086).

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